July 1, 2001

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

SPECIAL PROVISION

FOR

STATE PROJECT _____input State #_____

FEDERAL PROJECT _____input Federal #_____

FOR

SECTION 615

STEEL STRUCTURES

615.1 – GENERAL:

615.1.1 – Description:

ADD THE FOLLOWING TO THIS SUBSECTION:

Only fabricators meeting the requirements of the AISC Quality Certification Program, "Major Steel Bridges (Cbr)" with "Fracture Critical Members Endorsement (F)" shall be used to fabricate HPS 70W [HPS 485W] steel.

615.3 - MATERIALS:

615.3.1.1 – General:

ADD THE FOLLOWING TO THIS SUBSECTION:

Welded girder made of AASHTO M 270/M 270M-00, Grade HPS 70W [HPS 485W], steels shall be fabricated in accordance with the AASHTO "Guide for Highway Bridge Fabrication with HPS 70W [HPS 485W] Steel" which supplements the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.

615.3.1.4 – High-Performance Steel:

ADD THE FOLLOWING TO THIS SUBSECTION:

Structural Steel designated on the plans as Grade HPS 70W [HPS 485W] shall conform to the requirements of AASHTO M 270/M 270M-00 (or later version), Grade HPS 70W [HPS 485W]. Supplementary Requirement S83, Non-Fracture-Critical Material Toughness Testing and Marking will apply, and must be specified with the mill order.

615.3.1.4.1 – Quenched and Tempered High Performance Steel: Quenched and tempered high performance steel plates are available from the manufacturer in Grades HPS 70W [HPS 485W] and HPS 100W [HPS 690W]. However, only Grade HPS 70W [HPS 485W] with a minimum specified yield point of 70 ksi [485 Mpa] will be allowed. The manufacture, testing, delivery and requirements for mill inspection for quenched and tempered HPS 70W [HPS 485W] steel must comply with all provisions of AASHTO M 270/M 270M-00, ***Standard Specification for Carbon and Low Alloy Structural Steel Shapes, Plates and Bars, and Quenched and Tempered Alloy Structural Steel Plates for Bridges.***

615.3.1.4.2 – Non-quenched and Tempered, Thermo-mechanical-controlled- processing High Performance Steel: As an option, non quenched and tempered, thermo-mechanical-controlled-processing (TMCP) HPS 70W [HPS 485W] steel plates with a minimum specified yield point of 70 ksi [485 MPa] are also available from the manufacturer, and may be directly substituted for the quenched and tempered product. TMCP HPS 70W [HPS 485W] is not currently included in AASHTO M 270/M 270M-00 specifications. However, except for the rolling and heat treating processes, the manufacture, testing, delivery and requirements for mill inspection of TMCP HPS 70W [HPS 485W] steel must comply with all provisions of AASHTO M 270/M 270M-00, ***Standard Specification for Carbon and Low Alloy Structural Steel Shapes, Plates and Bars, and Quenched and Tempered Alloy Structural Steel Plates for Bridges***.

615.4 – FABRICATION:

615.4.1 – Identification of Steels During Fabrication:

ADD THE FOLLOWING TO TABLE 615.4:

Grade HPS 70W [HPS 485W] - Blue & White

615.4.3.3.3 – Hot Bending:

ADD THE FOLLOWING TO THIS SUBSECTION:

Grade HPS 70W [HPS 485W] steel to be bent shall not be heated to a temperature greater than 1100ºF [590ºC]. Requenching and tempering is not required for Grade HPS 70W [HPS 485W]

steel heated to this limit.

615.4.7 – Straightening Material:

ADD THE FOLLOWING TO TABLE 615.4.7:

Grade HPS 70W [HPS 485W] > 6" [150 mm] from weld	-	1100ºF [590ºC]
Grade HPS 70W [HPS 485W] < 6" [150 mm] from weld	-	950ºF [510ºC]

615.4.12.2.1 – Materials:

REPLACE THIS SUBSECTION WITH THE FOLLOWING:

Except for Grade HPS 70W [HPS 485W] steel, steels that are manufactured to a specified minimum yield point greater than 50 ksi [345 MPa] shall not be heat curved.

615.4.12.2.3 – Temperature:

ADD THE FOLLOWING TO THE FIRST SENTENCE:

.. except that the temperature of HPS 70W [HPS 485W] steel shall not exceed 1100ºF [590ºC].

615.5 – ASSEMBLY:

615.5.7 – Welding:

ADD THE FOLLOWING TO THIS SUBSECTION:

A) Only submerged arc and shielded metal arc welding are permitted when welding HPS 70W [HPS 485W] steel. Consumable handling requirements shall be in accordance with AWS D1.5-95, Sections 12.6.5 and 12.6.6.

B) Filler Metal Requirements:

(1) Unless otherwise noted on the Plans, filler metals for all fillet welds shall be in conformance with AWS D1.5, Table 4.1 (H8 maximum), for AASHTO M 270/M 270M, Grade 50W [345W] base metal.

(2) Filler metals for single pass fillet welds need not meet the requirements for exposed bare applications of Section 4.1.4 of AWS D1.5-95 as long as they comply with Section 4.1.5.

(3) Filler Metals for all full penetration groove welds connecting a Grade HPS 70W [HPS 485W] plate to a Grade 50W [345W] plate shall conform to the requirements for Grade 50W [345W] Base Metal as listed in AWS D1.5, Table 4.1 (H8 maximum), or those listed in paragraph 4 below, at the Fabricators option.

(4) Filler Metals for matching fillet welds when required by design, and all groove welds connecting Grade HPS 70W [HPS 485W] plates shall conform to the following requirements:

(a) Submerged Arc Welding (SAW) Consumables;
LA85 electrode with Mil800HPNi flux, by Lincoln Electric Company.
SAW consumables shall meet the hydrogen control level of H4 as discussed in AWS D1.5, Section VIII6.2.2.1(1).

(b) In lieu of the filler metals for SAW in (A) above, the contractor may request approval of alternate consumables from the Engineer. 'Alternate' manufacturer specific filler metals, both electrode and flux, shall meet AWS Electrode/Flux Classification F9A4 EXXX-X, with supplementary moisture resistance designators -H4 or -H2, as per AWS A5.23, with 1% Nickel, minimum in the weld deposit.

In addition to the requirements for Welding Procedure Specification (WPS) qualification in accordance with AWS D1.5, when using 'alternate' consumables, diffusible hydrogen (H_d) tests shall be performed on the weld metal. Minimum preheat and interpass temperatures to be used with 'alternate' consumables shall be in accordance with AWS D1.5, Table 4.4. The deposited weld metal shall have a diffusible hydrogen level equivalent to 4 mL/100g or less. H_d test specimens are to be prepared at the fabrication plant. Specimens are to be tested in accordance with AWS A4.3. Test results in excess of 4 mL/100g are unacceptable, and a retest is required, with or without revised welding procedures. AWS D1.5, Section 5.7.6, Exemption from Further Testing, is applicable, but WPS or H_d results are not transferrable from fabricator to fabricator. Fabricators with multiple plants under a common umbrella of welding equipment, welding training, and Supervision need to perform the H_d testing only once per combination of consumables for each location. Plants audited as a single facility by the American Institute of Steel Construction (AISC) as a part of their Quality Certification Program, or other owner approved equal Quality Assurance Program, are considered one location. Multiple plants not falling under the AISC, or other 'single facility' audit definition, are considered separate facilities and additional WPS and H_d tests are required.

(c) Shielded Metal Arc Welding (SMAW) Consumables;

Matching - E9018**RHZ**

- the Designator '***R***', for moisture resistant coating, is required for all SMAW electrodes used for welding HPS 70W [HPS 485W] steels. HZ shall be either H4 or H8, depending upon the level of preheat used.

Undermatching - E7018**MR**

- the Designator 'MR', for moisture resistant coating, is required for all SMAW electrodes used for welding HPS 70W [HPS 485W] steels.

(5) Except for single pass fillet welds, or ones that will be fully incorporated into a finished weld with satisfactory weathering characteristics, SAW consumables and SMAW electrodes shall produce weld deposits that meet the requirements of AWS D1.5, Table 4.3.

(6) Qualification Testing; Filler Metal Qualification Test Requirements for welding of HPS 70W [HPS 485W] plates together are as listed in AWS D1.5, Table 4.1, for Grade 70W base metal. Qualification, Pretest and Verification Test Requirements for HPS 70W [HPS 485W] groove welds as determined using WPS Test Plates shall provide properties equal to or greater than Base Metal requirements as specified in AASHTO M 270/M 270M-00. Qualification tests of a consumable using HPS 70W [HPS 485W] quenched and tempered steel does qualify consumable for welding TMCP HPS 70W [HPS 485W] steel. Conversely, qualification using TMCP HPS 70W [HPS 485W] steel does qualify consumable for welding HPS 70W [HPS 485W] quenched and tempered steel.

Further, all procedure qualification tests must be ultrasonically tested in conformance with the requirements of AWS D1.5-95, Section 6, Part C. Evaluation must be in accordance with AWS D1.5-95, Table 9.1, Ultrasonic Acceptance – Rejection Criteria – Tensile Stress. Indications found at the interface of the backing bar may be disregarded, regardless of the defect rating.

Whenever magnetic particle testing is done, only the yoke technique will be allowed, as described in Section 6.7.6.2 of the ANSI/AASHTO/ AWS D1.5 Bridge Welding Code, modified to test using alternating current only.

In general, post weld heat treatment shall not be required. The use of such post weld heat treatment shall require additional qualification testing.

C) Preheat and Interpass Temperature:

1) The maximum interpass temperature for welding HPS 70W [HPS 485W] steel is 450^0F [230ºC].

Matching Strength: The minimum preheat and interpass temperatures for 'matching strength' fillet and groove welding of HPS 70W [HPS 485W] steel plates using consumables listed in B(4)(a) shall be in accordance with the following Table:

Minimum Preheat and Interpass Temperature, ^{0}F [^{o}C], for HPS 70W [HPS 485W](1)(2)

Welding Process	H_d Max.	Thickness of Thickest Part at Point of Welding, in [mm](3)			
		To ¾ [19] Incl.	Over¾ [19] to 1-1/2 [38] Incl.	Over 1-1/2 [38] to 2-1/2 [64] Incl.	Over 2-1/2 [64]
SAW/SMAW (4)	4 mL/ 100g	50 [10]	70 [20]	70 [20]	125 [50]
SMAW	8 mL/ 100g	50 [10]	125 [50]	175 [80]	225 [110]

Notes for Table:

(1) For 'alternate' consumables, the minimum preheat and interpass temperatures shall be in accordance with AWS D1.5, Table 4.4.

(2) If satisfactory results are not achieved with the above minimum preheat and interpass temperatures during development of the Welding Procedure Specification (WPS), and an increased preheat temperature is used to provide a satisfactory Procedure Qualification Record (PQR), the higher preheat temperature shall be used during bridge fabrication as the required minimum.

(3) The minimum preheat or interpass temperature required for a joint composed of different base metals and/or thicknesses, shall be based on the highest of the minimum preheat from AWS D1.5, Table 4.4 or the Table above.

(4) Diffusible hydrogen of filler metal tested by manufacturer shall not exceed a H4 classification. Heat input shall be limited as indicated in Section 2(d) below

2) Undermatched fillet welds; The preheat/interpass temperature requirements shall be in accordance with AWS D1.5, Table 4.4 for Grade 50W [345W] steel.

D) Heat Input (HI);

40 kilojoules per inch (kJ/in), minimum
90 kJ/in, maximum
as determined using AWS D1.5, Section 5.12.

E) Backing;

AWS D1.5, Section 5.4.5 is modified to allow steel backing material for WPS test plates to be of Grade 50W (Sulphur = 0.025 max.) or HPS 70W [HPS 485W] material.

F) Transition at butt joints;

AWS D1.5, 9.16.3, is modified to allow a straight (width) transition for butt joints with HPS 70W [HPS 485W] steel consistent with the fatigue rules of AASHTO.